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In Cooperation with the South Dakota Agricultural Experiment Station

SOIL SURVEY
OF
BROWN COUNTY, SOUTH DAKOTA

BY

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SOIL SURVEY OF BROWN COUNTY, SOUTH DAKOTA

By W. I. WATKINS, United States Department of Agriculture, in Charge, and G. A. LARSON, South Dakota Agricultural Experiment Station

COUNTY SURVEYED

Brown County is in the northeastern part of South Dakota. It is rectangular in shape, having a width east and west of 36 miles and a length north and south of 48 miles. The North Dakota State line forms the northern boundary. The land area of the county is 1,719 square miles or 1,100,160 acres; the water area is 9 square miles.

Brown County has two distinct topographic divisions, the prairie plains and the bed of glacial Lake Dakota which occupies a broad belt extending in a northeast-southwest direction across the county. The line separating these two regions is almost straight, passing diagonally through the county from section 5, T. 128 N., R. 61 W., southwestward to section 36, T. 121 N., R. 65 W. The eastern limit of the lake bed crosses the southeastern corner of the county, following a line extending from the southeast corner of Groton Township to Ferney then southward to the county line.

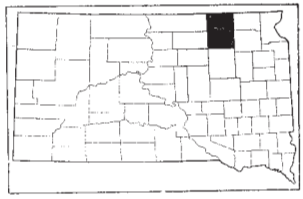

FIGURE 1.—Sketch map showing location of Brown County, S. Dak.

The elevation of that part of the county within the lake basin is about 1,300 feet above sea level. South of a line running through Houghton, Huffton, and Claremont, the surface is flat and smooth, but north of this line it ranges from flat to undulating or billowy in spots. The billowy land is east and southeast of Houghton, and a chain of low sand hills extends across the eastern edge of Portage Township.

The prairie plains in the southeastern corner of the county are undulating, with long gentle slopes toward the lake bed. This slope merges into terraces from 1 to 3 miles wide bordering the lake basin. The relief of the prairie region lying west of the lake basin varies from almost flat to strongly rolling, but is prevailingly undulating. The smoother areas are in the north-central part of the county, in Liberty, Savo, Greenfield, Richland, and parts of Brainard Townships, and in the southwestern corner. The remainder of the county is more undulating, and here and there are small sharp knolls. Such knolls are in the northwestern corner of the county and in Westport Township. The rougher areas in the vicinities mentioned are near some of the larger or more pronounced sloughs and along the middle and upper part of Elm River. The average elevation of the prairie plains region is between 1,300 and 1,400 feet above sea level. The Lake Dakota basin is uniformly lower. The elevation gradually rises away from the lake basin, the ascent being more rapid in the southeast corner of the county.

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The entire county drains through James River. The flood plain of James River varies from three-fourths to 2 miles in width. The widest parts are north of Columbia Township and south of the town of Tacoma Park. The remainder of the stream bottom is about three-fourths mile wide.

The boundaries of Brown County were established in 1872, and the county was organized in 1879 from old Beadle and Mills Counties. The first settlements were trading or Army posts. The first permanent settlement was made in 1865 along Elm River, in the vicinity of Ordway. The early settlers came mainly from Iowa, Minnesota, and Wisconsin. Most of the inhabitants are of Scandinavian and German descent.

Columbia, the first town, was organized in 1879, Aberdeen and Ordway in 1880, and Groton in 1881. The county seat was first located at Columbia, was later moved to Aberdeen, and after a contest was definitely located at Aberdeen in 1890.

The rural population of Brown County is only slightly more than the urban population. The average density of the rural population to the square mile is 8.6 persons. Aberdeen, the county seat, is located in the southwestern part of the county and has a population of 14,537, according to the 1920 census. Aberdeen is the second largest city in the State and is one of the chief distributing and railroad centers.

As a whole, Brown County is well supplied with railroads and trading points. Four railroad systems, the Chicago, Milwaukee, St. Paul & Pacific, the Minneapolis & St. Louis, the Chicago & North Western, and the Great Northern form a network in the county and give easy access to all points and outside markets.

The chief outside markets are Minneapolis, St. Paul, Chicago, Sioux City, and Sioux Falls. In all probability a packing plant recently established at Huron will also afford a marketing place for livestock.

The county is well supplied with urban and rural schools. A large percentage of the rural schools are South Dakota standard schools. A few consolidated schools are operated for the rural districts.

Aberdeen is connected with all outlying towns and counties by graveled county and State roads. The Yellowstone Trail passes through Groton and Aberdeen and continues west; the Sunshine Highway passes north and south through Frederick, Westport, Aberdeen, and Warner. Most of the dirt roads are well graded. Except in the western tier of townships and in the northeastern corner of the county, roads follow almost all section lines. During seasons of heavy rainfall water collects in the sloughs along the roads, making all except the well-kept graded roads impassable for automobiles. The streams are fairly well bridged.

CLIMATE

The climate of Brown County is subhumid, with comparatively long cold winters and short cool summers. The summer days are generally long and warm and the nights short and cool. The fall months are characterized by clear, cool weather with little rainfall.

Thawing weather usually begins about the first of March, and field work begins the latter part of March or the first of April. The ground freezes but little before Thanksgiving. The winters are usually cold, with the thermometer falling from −25° to −46° F. for short periods, but the air is dry and the cold less penetrating than in more humid climates. In summer, temperatures may rise to 111° for a day or two.

The average date of the latest killing frost is May 15 and of the earliest is September 23. This gives an average frost-free season of 130 days. The latest killing frost recorded was on June 21 and the earliest was on August 20. The average growing season is sufficient for maturing the various crops grown.

The mean annual rainfall of 26.44 inches is the largest recorded in northeastern South Dakota. The rainfall decreases both east and west of Aberdeen. The rainfall is evenly distributed from April to August, the time when moisture is most needed by crops. The rain, together with the moisture stored in the soil from the melted snows, is generally sufficient for crops. The average snowfall of 44.2 inches practically all occurs from November to March. The fall of snow is heaviest in March. Hot south winds blowing from one to three days sometimes do considerable damage to crops in the summer.

Table 1, compiled from data of the United States Weather Bureau station at Aberdeen, gives the normal monthly, seasonal, and annual temperature and precipitation in Brown County.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Aberdeen*

[Elevation, 1,300 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1910)	Total amount for the wettest year (1896)	Snow, average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	16.9	60	−35	0.83	0.25	0.50	6.1
January	9.5	59	−46	.80	.52	.77	7.3
February	11.2	67	−39	.89	1.20	2.41	8.7
Winter	12.5	67	−46	2.52	1.97	3.68	22.1
March	26.2	88	−31	1.87	.80	4.42	11.6
April	44.8	95	0	3.32	2.28	6.50	3.0
May	55.8	96	17	3.87	1.40	3.76	1.0
Spring	42.3	96	−31	9.06	4.48	14.68	15.6
June	66.1	104	28	4.04	3.00	6.26	.0
July	70.9	109	35	3.22	1.07	1.64	.0
August	69.0	111	34	3.13	2.47	2.55	.0
Summer	68.7	111	28	10.39	6.54	10.45	.0
September	59.0	104	18	1.82	1.20	2.76	Trace
October	45.7	92	−6	1.79	1.07	3.62	1.9
November	28.8	79	−25	.86	.20	3.20	4.6
Fall	44.5	104	−25	4.47	2.47	9.58	6.5
Year	42.0	111	−46	26.44	15.46	38.39	44.2

AGRICULTURE

Very little farming was carried on in Brown County before 1880. After that date settlement was rapid, owing to the construction of railroads. By 1900, the acreage of cultivated land was nearly equal to that of to-day. Although the population of the county has nearly doubled since 1900, the increase has been in the towns. Wheat, until 1900, occupied more than 80 per cent of the acreage devoted to grain. Since that time, the percentage of land in wheat has gradually declined and is now less than 50 per cent. In 1924, the average farmer in the county grew 114 acres of wheat, 72 acres of corn, 46 acres of oats, 27 acres of barley, and 14 acres of flax and rye.[1] The proportion of the farms devoted to these crops varies widely. Some farms are devoted almost exclusively to wheat, and on others corn is the principal crop and little or no wheat is grown. The large corn acreage almost invariably indicates a well-balanced farming system including the raising of livestock. A detailed study of farms by the Department of Farm Economics in 1925 and 1926 shows that although wheat continues to be the most important single crop the trend is toward an increasing acreage of feed grains and legumes, toward the raising of more livestock, and toward a better-balanced farming system.[1]

The acreage devoted to wheat in 1889, according to the 1890 census, was 326,309 acres, and the average yield was 6 bushels to the acre. In 1919 the average yield was given as 8.9 bushels to the acre on 339,401 acres. It is very doubtful if this acreage has since been maintained. The yields vary from practically nothing to more than 25 bushels to the acre, depending on the season and damage from rust and pests.

Most of the wheat grown is spring wheat, and Brown is one of the leading counties in the State in the production of hard spring wheat. The wheats grown are the common or bread wheats and the durum or macaroni wheats. The most important varieties of hard red spring wheat are the Marquis, Kota, and Ruby. The Marquis leads in popularity, and its high milling and bread-making qualities make it a standard of comparison for this class of wheats. Black stem rust attacks Marquis wheat severely in some seasons, causing yields to be very low. The Kota variety is more resistant to rust, but its quality is considered inferior. The Ruby matures earlier than the Marquis and often escapes injury from rust. On the plats of the experiment station at Brookings in the years 1915 to 1925, inclusive, the average yield of Marquis wheat was about 12.6 bushels to the acre, and at Highmore experiment station, near the center of the State, the average yield during the nine years, 1917 to 1925, inclusive, was about 12.5 bushels. The range in yields at Highmore was from 1.3 bushels in 1921 to 28.6 bushels in 1924. The average yield of Ruby wheat at Brookings from 1921 to 1925 was 14 bushels to the acre and at Highmore was 17.3 bushels. The average yields of Kota are slightly higher than those of Ruby.

The durum wheats are of two general classes, the amber and the red durums. The Pierson and the Kubanka are the principal amber

[1] BONNEN, C. A., and ROGERS, R. H. PROFITABLE FARMING SYSTEMS FOR THE INTENSIVE SPRING WHEAT AREA IN SOUTH DAKOTA. S. Dak. Agr. Expt. Sta. Bul. 235, 48 p., illus. 1928.

durums grown in the county. The Acme and Monad, D—1, are more rust resistant than the Kubanka, which they resemble, but they are inferior in quality. The principal red durum is Pentad, also known as D—5. This is the highest-yielding durum wheat, but it is also of the poorest quality. The yields of Kubanka at the experiment station at Brookings in the 8-year period 1918 to 1925, inclusive, ranged from 2.8 bushels to the acre in 1921 to 34.2 bushels in 1925, with an average during the entire period of 14.8 bushels. During the same period the Acme and the Monad varieties averaged 19.4 bushels.

Oats have always been one of the more important crops grown. The acreage of oats increased from 41,511 in 1889 to 70,695 acres in 1919. Oats still remain one of the principal money and feed crops. This crop is usually drilled and harvested earlier than wheat. The Sixty-Day is the standard variety, and yields in good years may be as high as 50 bushels to the acre. The average for the county is about 30 bushels. The two principal late oat varieties are Silvermine, a medium late oats yielding about 40 bushels to the acre in good seasons, and New Victory, a late oats giving about the same average yield. The Hulless oats, which yields about 30 bushels to the acre, is also an important variety. The 1919 census showed oats to have the second largest acreage of the crops grown, with rye third and corn fourth, but the corn acreage now ranks above the oat acreage and the rye acreage has fallen below that of barley and flax.

The corn acreage has increased from 3,139 acres in 1889 to 18,217 acres in 1899, 35,374 acres in 1909, and 53,739 acres in 1919. In 1924, according to the 1925 census, the acreage was 163,363 acres. Most of the corn is of the small-eared varieties, which are more certain to mature, but some flint corn is grown. A large part of the corn is used on the farm for fattening hogs or for feeding work animals. The surplus is sold. The principal varieties are Minnesota 13, which does especially well on the sandy lands and in the Lake Dakota basin. Silver King is an important white corn. North Dakota Flint, Rustler White Dent, and Rainbow Flint are other good varieties, to which the Barnes soils are probably especially well adapted. Brown County white dent and Brown County yellow dent are two good general varieties of corn which usually mature. The flint varieties are good for hogging down.

According to the United States census, rye occupied 68,580 acres in 1919, when the average yield was 9.6 bushels to the acre. The acreage in 1924 had fallen to 10,921 acres. The principal varieties of rye are Advance and Rosen.

Barley is a crop of considerable importance. The census figures show a gain from 16,555 acres in 1889 to 48,397 acres in 1919. The largest acreage was reported in 1909, when 89,678 acres were grown. Odessa is the principal variety.

Flax at one time was an important crop. It is planted mostly on virgin or sod land. The greatest acreage reported was 49,298 acres in 1909. This has dropped to 8,685 acres in 1919. It is doubtful if the acreage has increased since then. Common flax and wilt-resisting varieties are grown.

Alfalfa and sweetclover are grown to a considerable extent. They are not only valuable as forage but also for pasture and for keeping up the nitrogen content of the soil. Alfalfa yields about 3 tons of hay to the acre from two cuttings or about 2 tons of hay from one

cutting and a seed crop of about 200 pounds. The principal varieties are Grimm, Cossack, and South Dakota common or Dakota No. 12. Sweetclover is probably the best to use for pasture, as yields of both hay and seed are heavier. The principal varieties are common white biennial, Crystal Dwarf, and Grundy County White. The following are some data collected by the county agent on the relative value of sweetclover and native grasses as pasture. The data were taken on seven farms located on the same sections in each township. The average price of land was $80 and taxes 80 cents an acre. On the native pasture the average number of acres needed to feed a cow and calf was 4.6. The gain in weight of cow and calf during the pasture season was 20 pounds. On sweetclover pasture the average number of cattle to the acre was two. The cow gained 70 and the calf 100 pounds.

Timothy is grown to a small extent, 1,702 acres being reported by the 1920 census for 1919. The census shows a total of 94,741 acres of wild, salt, and prairie grasses cut for hay the same year. A large percentage of this hay comes from the poorly drained spots that could not be used advantageously for anything else, but with such yields it is not economical to keep tillable land in grass for hay or pasture.

Potatoes are the only vegetable crop grown to any extent. The acreage has remained about 3,000 acres since 1889, and yields have ranged from 47 to more than 100 bushels to the acre. The average production for the county in the three years, 1922 to 1924, inclusive, was 298,033 bushels and the surplus above home consumption was 91,113 bushels.[3]

Fruits are of very little importance in the county. Plums have always been the most important tree fruit, and the number of trees has gradually increased. The 1920 census shows there were 7,562 trees in 1919. Cherries ranked second in importance, with 951 trees, and apples ranked third, with 845 trees. Only a few grapes are grown. Strawberries are the chief small fruit.

The 1920 census gives a total value of cereals produced in 1919 as $11,659,026 and of hay and forage as $2,636,814. The estimated value of animals sold and slaughtered was $1,830,808. Other important items of farm income in 1919 were as follows: Dairy products, with a value of $564,872; vegetables valued at $459,913; and poultry and eggs valued at $434,503.

Most of the livestock raised are hogs and cattle. The standard breeds are represented. Considerable interest is taken in the breeding of good hogs. The principal beef breeds are Hereford, Angus, and Galloway. Sheep are of minor importance, but some farmers follow the practice of shipping in western lambs and fattening them on the pigeon grass or foxtail that grows in the stubble fields and allowing them to graze in the picked cornfields.

There are a few dairy farms in the vicinity of Aberdeen, but most of the dairying is carried on as a side line to general farming. The principal breed of dairy cattle is the Holstein. Like dairying, poultry raising is carried on in conjunction with general farming and is rapidly growing in importance.

The 1920 census reports a total of 2,305 farms in the county, comprising 90.9 per cent of the area and averaging 441.7 acres to the farm,

[3] WERTZ, V. R. SOUTH DAKOTA POTATOES—PRODUCTION, PRICES, DESTINATIONS. S. Dak. Agr. Expt. Sta. Bul. 234, 40 p., illus. 1928.

of which 382.9 acres are improved. The average value of the farms in 1880, according to the census, was $1,529. This increased to $5,187 in 1900, to $27,101 in 1910, and to $42,626 in 1920. The 1920 valuation is probably a little higher than the present valuation. The principal item in the valuation is the land, which in 1920 comprised 77.4 per cent of the total. Domestic animals were originally the principal item in farm valuation. In 1920 domestic animals represented 7.2 per cent of the value of the farm, implements 5 per cent, and buildings 10.4 per cent. The average value of the land was $74.68 an acre.

The principal item of farm expenses is labor. The 1920 census gave this item for 1919 as an average of $1,014.22 a farm for the 1,976 farms reporting. Feed ranked second, with an average of $343.05 a farm for 1,298 farms reporting. The average expense for fertilizer for four farms was reported as $160. The number of farmers reporting the use of fertilizer is significant and reflects credit to the fertility of the soil.

Most of the farmers follow some kind of a crop rotation, usually corn, small grain, and legumes in some combination. Legumes are not widely used for green manures, but the abundant pigeon grass and weeds which grow in the stubble fields furnish considerable organic matter. Most farmers conserve and use barnyard manure. More attention is being given each year to conserving the fertility of the soil and to increasing the supply of plant food.

The percentage of farms reported operated by owners by the 1920 census was 55.2 per cent. The percentage has decreased gradually since 1890, when 87.65 per cent of the farms were operated by owners and 12.35 per cent by tenants. The farms are rented for cash or on a share-crop basis.

The average farm in the county is well improved, with good house, barn, and outbuildings. Electrically or gas lighted houses are numerous. Artesian wells furnish abundant water for most of the county. A large percentage of the fences are of woven wire. Motor-driven farm machinery is not uncommon, but the greater part of the land is plowed by horses. Two-row cultivators are used for cultivating corn.

SOILS

The soils of Brown County owe their most striking and important characteristics to their geographic position. The decrease of rainfall westward in the central part of the United States and the corresponding decrease in moisture supply in the soil have resulted in less weathering and leaching of the soil materials. Climatic forces have acted uniformly over the county on variable materials and have developed soils which are remarkably uniform in appearance and composition.

Minor soil variations are the result of differences in drainage and in the texture of the original materials from which the soils have developed. The comparatively low moisture supply of the region has not been sufficient to support a forest vegetation but has been favorable to the growth of grasses. These grasses have been the source of the organic matter which imparts a dark color to all the soils of the region.

Brown County lies in a belt in which the soils have a darker color than any other normally developed well-drained soils in the United

States. Although the soil water is ample to allow the production and accumulation of large quantities of black organic matter from the partial decay of grass roots, it is not sufficient to leach the soil to any great depth. In well-drained areas the carbonates, namely lime carbonate, occur in only small quantities in the surface soil, owing partly to leaching, but below a depth ranging from 18 to 24 inches the content is large, and an actual accumulation of carbonates seems to have taken place.

The principal soil of the well-drained upland has reached a fairly uniform stage of development, which may be regarded as normal for this climatic zone. The upland soils are characterized by three distinct layers, or horizons, which for convenience are given the designations A, B, and C. These major layers may be subdivided according to local variations, but the three general divisions are everywhere present.

In cultivated areas the surface soil, or A horizon, is dark colored to a depth varying from 8 to 14 inches. In the virgin soil this surface horizon consists of two layers which have the same color but slightly different structure. The material is either very finely granular or single grained and is loose and friable. The structure particles are uniform in color, and the color is not changed when the material is crushed. To a depth of 2 inches this material is nearly everywhere filled with grass roots forming a sod. The lower part of the A horizon, below a depth of 6 or 8 inches, is slightly more firm and when broken crumbles into a mass of small, soft clods or imperfect granules. These structure particles are larger than those of the upper part of the horizon. In some places a columnar structure is noticeable in the lower part of this horizon.

The next layer is the upper part of the B horizon. It is nearly everywhere heavier in texture than the horizon above, in many places being heavy clay. This material is rather compact and in places is distinctly columnar, but it breaks into angular fragments larger than the granules in the A horizon. The true color of these particles is brown, but the dark-colored organic matter has been carried down from above and deposited over the particles as a coating. The dark color decreases downward, as the content of organic matter becomes less. This layer is commonly from 10 to 15 inches thick. The lower part of the B horizon is grayish brown or grayish yellow with a faint olive tinge, and scattered through it are spots of light-gray or white lime carbonate. The lime may also be present as small concretions, as coatings along the breakage planes, and as deposits in small root channels, animal burrows, and wormholes. The material constituting the lower layer of the B horizon breaks up into soft clods. This layer varies in thickness from 8 to 16 inches and is apparently a zone of lime accumulation, since it contains a higher percentage of carbonate than the A horizon and apparently more than the horizon below it.

The underlying C horizon consists of the parent material which has been but little altered by weathering. Its color is grayish yellow, with a slight olive tinge. Commonly lime carbonate is present uniformly throughout the mass. The material is in most places silty and structureless. It breaks into soft clods.

Upland soils which have reached the stage of development just described are shown on the accompanying soil map as members of

the Barnes soil series. The Bearden soils, on the higher terraces, have characteristics similar to those just described and in a broad classification belong to the same group. The Pierce soils on the upland have loose, porous subsoils which in some places have prevented the development of a B horizon and the accumulation of lime, but lime is everywhere present in the parent materials. The Beadle soils differ in having a heavy compact clay layer just above the layer of lime concentration. The Beadle soils occur on nearly level areas on the upland. The heavy claypan is caused, no doubt, by the action of alkali salts originally present in the parent material, and its development was probably favored by the restricted drainage and in places by the imperviousness of the parent material.

About half the soils of Brown County have been formed from glacial drift which was laid down by the Wisconsin ice sheet and which consisted of a mixture of ground granites, gneiss, schist, and the more local shales and sandstones. The ice left the materials with a fairly smooth surface. Since deposition the present profile has been developed by the prevailing climatic agencies.

During the retreat of the ice sheet, what is now Brown County was also covered by a glacial lake known to geologists as Lake Dakota. Lacustrine deposits, mainly of sandy loam and silt, were left in this old lake basin. Soils developed over these materials have been classed mainly in the Bearden, Fargo, and Aberdeen series. These soils, where drainage is good, have developed about the same profile as the upland glacial soils, but in the poorly drained areas they have been modified. The Bearden are the well-drained soils of this group, the Aberdeen with a heavy claypan correspond to the Beadle of the upland, and the Fargo are poorly drained soils.

In the sandy area of the northeastern corner of the county, where the surface is billowy, the wind has sorted and shifted the soil material. Such areas are in Detroit Township and along the edge of the James River Valley and the larger sloughs or old stream channels winding through the Lake Dakota basin.

Comparatively narrow strips of low alluvial land occur along the streams. These have developed over sediments brought down from the drift-covered uplands and from the higher lake-basin terraces. Most of these soils have not developed any definite profile. Stream erosion has not been extensive, and the area eroded and dissected along the streams is very narrow. Erosion is probably best developed along Elm River and its main tributaries.

The surface layer of the Barnes soils, to a depth ranging from 4 to 8 inches, is friable. It is very dark grayish brown when dry and black when wet. The soil is underlain, to a depth ranging from 12 to 30 inches, by brown friable material of heavier texture than the surface soil. This layer when dry has a well-marked columnar structure, being made up of a mass of irregular columns ranging from 2 to 6 inches in diameter. Below this is the zone of lime accumulation consisting of grayish-yellow or almost white structureless, floury, silty loam. Lime is abundant either in the form of nodules or soft concretions which give the soil a speckled appearance, or in a finely divided form throughout the material, giving it a light-grayish color. (Pl. 1, A.) This zone is in most places from 12 to 18 inches thick. The columnar structure in the layer above continues into the upper

part of this layer but disappears in the middle and lower part. Below the zone of lime accumulation, at a depth ranging from 30 to 40 inches, is the parent material of glacial drift. This is yellow or grayish-yellow with brown or reddish-brown iron stains and gray mottles. It is structureless and crumbles readily to a fine, silty, floury powder. This layer is highly calcareous but shows no lime accumulation. Some gravel and bowlders occur scattered over the surface or embedded in the soil. The silt loam, the loam, with a rough stony phase, and the fine sandy loam of this series are mapped.

The surface layers of the Beadle soils are very similar to those of the Barnes soils, being very dark grayish brown or black. The subsurface layers are dark-brown or almost black heavy compact clay which breaks into angular, cubical clods with edges sharper than clods of the Barnes soils. The lower part of this layer gradually becomes less heavy, more friable, and brown in color. Where the heavy compact layer is thin, the color of the entire layer is brown. This heavy compact layer overlies the zone of lime concentration that is found in the mature soils of this region. (Pl. 1, B.) The next lower layer is grayish-yellow friable drift similar to that under the Barnes soils. The columnar structure in the upper layers is similar to that found in the Barnes soils. Beadle silt loam is mapped.

The surface soils of members of the Bearden series range in color from very dark grayish brown to almost black. They are friable, mellow, and easily crumbled. The subsurface layers are brown and friable but not quite so friable as the surface soils. The zone of lime accumulation common to the soils of this region is present (pl. 2, A) and is very similar to that in the Barnes and Beadle soils. The deep subsoil is yellowish brown with some slight mottles of gray and brown or reddish brown. Lime is present in this lower layer, but not in so large quantities as in the layer above. The columnar structure common to the other mature soils is developed in the subsurface layer. The parent materials are lacustrine or alluvial deposits and were of a more uniform texture than the glacial drift from which the Barnes or Beadle soils were developed. The silty clay loam, silt loam, with a shallow phase and a channel phase, loam, very fine sandy loam, and loamy very fine sand, with a basin phase, members of the Bearden series are mapped.

The Sioux soils have rather open, mellow, friable, and finely granular surface soils ranging from dark grayish brown to almost black in color. To a depth between 3 and 5 inches the material is commonly a little less compact than that below. The subsurface layers are brown friable material which rarely effervesces when treated with hydrochloric acid, except possibly in the lower inch or two of the layer. The subsurface soil rests on beds of stratified calcareous sand and gravel which range in color from gray to yellow and rust brown. In places a slight cementation of the gravel has taken place, with iron as the cementing material. Just above the gravel is a layer of gray or grayish-yellow highly calcareous soil, which in few places, if anywhere, is more than 2 inches thick. The layers above the gravel layer have the typical columnar structure. These soils occur as glacial outwash or stream terraces. Sioux loam was mapped in Brown County.

The Pierce soils are the upland equivalent of the alluvial Sioux soils. The surface soils are brown, dark grayish brown, or black

and are friable, mellow, and finely granular. The subsoil is brown and of about the same texture and structure as the overlying material. The brown subsurface soil rests on beds of stratified or banded, more or less cross-bedded gravel and sand. These materials vary in color from gray to rust brown and are nearly everywhere calcareous. There is in most places a highly calcareous layer of soil, an inch or two thick, just above the gravel. The surface and subsurface layers have the usual columnar structure. These soils occur on knolls and ridges or as outwash plains. The fine sandy loam is mapped.

The Valentine soils are typically sandy, with a wind-blown relief. The sands from which they are derived have been gathered by the wind from reworked glacial, residual, or alluvial material. The surface soils are dark grayish brown, and the subsurface soils are lighter brown. The subsoils are commonly still lighter colored and, in Brown County, are yellow or grayish yellow. They are in most places of about the same or slightly heavier texture than the surface soil. No zone of lime accumulation occurs, and effervescence is not common. Valentine loamy very fine sand is mapped.

The surface soils of members of the Edgeley series vary from dark grayish brown to black and are finely granular and friable. The subsurface soils are brown and of slightly heavier texture but are friable. At variable depths these pass into a highly calcareous gravelly grayish-yellow layer which corresponds to the zone of lime accumulation in the Barnes and other soils. This layer also contains a large number of rotten shale fragments. The gravel is more abundant in it than in the corresponding zone of the Barnes and Beadle soils. It is underlain by calcareous, drab-colored, bedded but partly decomposed Pierre shale. The shale gradually becomes harder and at a depth of 2 or 4 feet the unweathered or slightly weathered shale is reached. In many places the shale comes within 2 feet of the surface. The Edgeley soils are really a thin Barnes soil underlain by shale. They contain sufficient alkali to affect the soil structure, which is columnar. Edgeley loam is mapped.

The Aberdeen soils have the same relation to the Bearden soils that the Beadle have to the Barnes. The surface soil, commonly silt or silty clay loam, is dark grayish brown or black. The soil is easily crumbled into fine particles of irregular size. Small iron concretions or buckshot are present in many places. The lower part of the surface soil, below a depth of 4 or 6 inches, is not so friable as the upper part and the particles are uniformly larger. The lower part of the surface soil, at a depth ranging from 8 to 16 inches, is a thin white or grayish layer composed of grayish-brown, ashlike, smooth floury silt with some brown mottles that appear to be immature iron concretions. Below the gray layer is heavy, compact dark-brown clay, from 3 to 12 inches thick, which breaks up into rectangular clods having rather sharp edges. The thinner layers have the brown color, whereas the thicker layers are black in the upper part and grade into brown underneath. When wet this heavy clay zone has a waxy sticky feel. A reddish tinge accompanies the dark-brown color in most places. The lower part of this heavy horizon grades into rather friable material which quickly passes into the zone of lime concentration common to the other mature upland soils. Aberdeen silt loam and Aberdeen silty clay loam are mapped.

The surface layers of the Fargo soils are black. The subsoils are as heavy or heavier in texture and vary from black to brown or drab in color. These soils may be calcareous throughout and are everywhere calcareous in the subsoils. A concentrated lime zone is present in many places. When wet the heavier soils are usually sticky. Members of the Fargo series are of lacustrine or alluvial origin. Fargo clay and Fargo silt loam are mapped.

The surface soils of members of the Maple series are very dark brown or black and are underlain by grayish-brown, dark-gray, or nearly white subsurface soils of about the same or heavier texture. The gray or white color depends on the quantity of lime that has accumulated, and the depth at which it lies depends on the thickness of the lacustrine accumulation. Below the lime zone the soil may be black or dark drab. It grades into water-logged yellow till in which are some gray or drab mottles. This in turn grades into the gray and brown mixed till found under the Barnes soils. When mapped within areas of Bearden soils the deep part of the subsoil has the characteristics of the Bearden instead of the Barnes soils. Maple clay, Maple silt loam, Maple loam, and Maple fine sandy loam are mapped.

The Lamoure soils have very dark-brown or black surface layers varying from friable to moderately friable. The subsurface layers are in most places about the same color but are heavier in texture. The subsoils vary from drab or gray to brown and black. The surface soils may be calcareous in places, and the subsoils are everywhere calcareous. The Lamoure soils vary considerably as they are composed of recently deposited alluvium. The clay, silty clay loam, and silt loam members of the Lamoure series are mapped.

In the following pages of this report the soils are described in full and their agricultural importance is discussed; their distribution is shown on the accompanying soil map; and their acreage and proportionate extent are given in Table 2.

TABLE 2.—*Acreage and proportionate extent of soils mapped in Brown County, S. Dak.*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Barnes silt loam	130,688	11.9	Sioux loam	6,848	0.6
Barnes loam	227,200	20.8	Edgeley loam	4,032	.4
Rough stony phase	896		Fargo silt loam	12,800	1.2
Barnes fine sandy loam	18,176	1.6	Fargo clay	17,472	1.6
Bearden silt loam	262,080		Maple silt loam	25,984	2.4
Shallow phase	11,648	25.5	Maple loam	11,200	1.0
Channel phase	8,128		Maple fine sandy loam	14,400	1.3
Bearden loamy very fine sand	74,688	7.5	Maple clay	16,832	1.5
Basin phase	8,000		Lamoure silt loam	13,952	1.3
Bearden very fine sandy loam	56,704	5.2	Lamoure silty clay loam	6,464	.6
Bearden loam	1,728	.1	Lamoure clay	24,896	2.3
Bearden silty clay loam	3,520	.3	Pierce fine sandy loam	1,344	.1
Valentine loamy very fine sand	46,656	4.2	Dune sand	1,920	.2
Aberdeen silt loam	48,000	4.4			
Aberdeen silty clay loam	14,080	1.3	Total	1,100,160	
Beadle silt loam	29,824	2.7			

BARNES SILT LOAM

The dry surface soil of virgin Barnes silt loam, to a depth ranging from 6 to 14 inches, is friable very dark grayish-brown silt loam. When wet the color is almost black. Below the dark-colored surface

soil is brown silt loam of about the same or slightly heavier texture, which in many places is slightly more compact than the overlying material. This brown layer gradually becomes lighter colored until, at a depth ranging from 16 to 24 inches, it grades into yellow or grayish-yellow, highly calcareous, friable silt or silty clay loam. This is the zone of lime concentration. The two upper layers and in places the upper 3 or 4 inches of the layer of lime concentration, when dry, show a well-developed columnar structure. The columns vary in diameter from 2 to 4 inches. They are easily broken into smaller columns 1 or 2 inches in diameter, which break at right angles to the vertical axis into oblong clods which, when put under pressure in the hand, break up into fine clods irregular in size and shape. The brown horizon does not break up into as fine particles as the surface soils. This columnar structure disappears in the zone of lime accumulation. The lower part of this zone is structureless and breaks into soft clods, irregular in size and shape, which are easily broken up into a smooth silty mass when pressed between the fingers. The lime occurs mainly as immature concretions disseminated in a finely divided condition through the soil. More rarely it is seen as hard concretions. The small immature concretions give this zone a white speckled appearance on a yellow background. This zone may vary greatly in thickness and in the percentage of lime present, but it commonly ranges from 10 to 24 inches in thickness. In a few places a yellow layer 2 or 3 inches thick occurs just above the zone of lime concentration. This yellow layer is low in lime. At a depth ranging from 38 to 44 inches the lime-concentration zone passes abruptly into highly calcareous, yellow, friable, mellow silty clay loam mottled with some drab and brown or reddish brown. This has not undergone thorough leaching. It is the parent material from which this soil is derived.

The greater part of the Barnes silt loam mapped in Brown County occurs in a large area west of James River and east of a line extending southwest from the State line just west of James River through Westport to the vicinity of Richmond. This area covers most of Savo, Liberty, Richland, Greenfield, Brainard, and Westport, and part of Lincoln, Townships. Another comparatively large area is in the southeastern corner of the county in Bates and Hanson Townships. Small areas are scattered throughout the northwestern part of the county. The area in the eastern part of Liberty Township seems to be slightly heavier and nearer a true silt loam than most of the soil. Small flatter areas occurring throughout the soil are true silt loam and have a heavier surface soil than typical. The relief varies from almost flat to strongly undulating. The more extensive flat areas are just west of James River north of Sand Lake. The soil as a whole is undulating. In surface texture the silt loam does not differ greatly from the loam.

Bowlders and gravel are scattered over the surface and throughout the soil, but the stones have been cleared from most of the areas, only a few remaining on the poorer spots or knolls. Where the stones are sufficiently numerous to interfere with cultivation, the areas are indicated on the soil map by stone symbols. Sloughs or potholes occur within areas of this soil but are not so numerous or so deep as in Barnes loam. They vary from less than an acre to more than 100 acres in area. The soils of those areas are grouped

in the Fargo and Maple series. These depressions serve as drainage basins for the surrounding higher soils. During extremely wet years they fill with water and sometimes cause considerable loss by isolating parts of fields. Knolls from which part of the surface soil has been removed by erosion occur but are not so common as in Barnes loam.

It is probable that 95 per cent of the Barnes silt loam is smooth enough for cultivation. All the crops common to the region do well on this soil. Small grains are said to do better on the Barnes than on the Bearden soils of the lake basin. The farms as a rule are well improved. The value of the land ranges from about $40 to more than $100 an acre, depending on improvements, location, and other considerations.

BARNES LOAM

Barnes loam has a very dark grayish-brown surface soil which when wet is nearly black. In the virgin areas the dark surface soil extends to a depth ranging from 5 to 10 inches. The lower part of this layer has a columnar structure similar to that found in Barnes silt loam and breaks up into rather small soft clods when pressed in the hand. The dark-brown horizon just below the black or darker horizon is generally heavier and slightly more compact, and in places is decidedly more compact than the overlying layer. It has a columnar structure similar to that of Barnes silt loam. The brown layer gradually becomes lighter colored with depth and at a depth ranging from 14 to 22 inches is underlain by yellow or grayish-yellow silt loam or silty clay loam which is easily reduced to a finely granular condition when rubbed between the fingers. This is the zone of lime accumulation, and the material effervesces freely when treated with hydrochloric acid. The lime may appear as immature concretions or may be evenly distributed through the mass. At a depth of 38 or 40 inches this layer passes abruptly into yellow silty clay mottled with drab and in most places with some brown or reddish brown. This lower material contains a high percentage of lime but no concretions such as occur in the horizon above.

Bowlders occur in varying numbers over the surface of this soil, but only in spots are they sufficiently numerous to interfere with cultivation or make the land unfit for cultivation. Bowlders occur mainly on the steep breaks to some of the larger streams, such as Maple and Elm Rivers and Foot and Snake Creeks. Very bowldery areas are shown on the soil map by means of stone symbols. Gravel beds occur within this soil mainly on the sharper knolls. The rock and gravel are covered on their lower surfaces by a lime coating. A strip of Barnes loam mapped in the western tier of townships has spots of decidedly heavier or compact subsoils, closely resembling the subsoil of the Beadle soils.

Pierre shale underlies the glacial drift from which the Barnes soils are derived, at a depth varying from 4 to 20 feet. In places on slopes to streams small areas of shale are exposed. Areas where Barnes loam is spotted by shale exposures are much more variable than the rest of the soil. Alkali accumulates in places, and as a whole this is not so desirable a soil as most of the Barnes loam. The area influenced by shale is west of a line extending northeast from the southeast corner of section 14 of Highland Township to the Minneapolis

& St. Louis Railroad in section 6 of Aberdeen Township, thence north along the west side of the east branch of Foot Creek and northward, taking in most of Allison and Palmyra Townships. This area probably reaches its most advanced development in Ravinia, Carlisle, and the northern part of Mercier Townships.

Barnes loam has a gently undulating or slightly rolling relief. Most of it is undulating, on the average slightly more undulating than Barnes silt loam. Barnes loam is mapped in a large area in the western part of the county. Most of it occurs west and south of the large area of Barnes silt loam. Smaller areas are in Bates Township and in the eastern half of Hanson Township. This soil is closely associated with Barnes silt loam, especially east of Dry Branch and Elm River south of its junction with Maple River and in New Hope and parts of Warner Townships. The soil as a whole, except for the areas in the extreme western part of the county, has about the same producing power as Barnes silt loam and is well adapted to the general crops. Small grains probably thrive better than does corn, especially on areas having the heavier subsoil. Lakes and sloughs and knolls where the soil is thinner are more common on this soil than on Barnes silt loam.

Barnes loam, rough stony phase.—Barnes loam, rough stony phase, has the same soil layers as typical Barnes loam, but in most places the layers are thinner. The separation of this phase is based mainly on relief and stoniness. Most of it is along the steeper and more eroded stream slopes on the upper part of Elm River and its main tributaries, or in areas so stony that the cost of clearing away the stone is prohibitive. The surface soil is thin, especially along the stream slopes, and gravel is more abundant than in the typical soil. In many places the lower part of the slope shows an occasional outcrop of Pierre shale and has a profile like that of Edgeley loam.

This soil is used exclusively for pasture.

BARNES FINE SANDY LOAM

Barnes fine sandy loam, to a depth ranging from 5 to 8 inches, has a very dark grayish-brown finely granular fine sandy loam surface soil underlain, to a depth ranging from 14 to 24 inches, by brown fine sandy loam or more commonly by brown finely granular loam having the same general structure as the surface soil. Below the subsurface soil is grayish-yellow heavy loam or clay loam heavily impregnated with lime. This is the usual lime-concentration zone found in the Barnes soils. Effervescence with hydrochloric acid is active. At a depth ranging from 30 to 48 inches, this lime material grades into the yellow or grayish-brown silty clay common under the other Barnes soils. A soil having a dark-brown fine sandy loam surface soil and brown fine sandy loam subsurface soil continuous to a depth of 30 inches is not uncommon. Below this is the till.

The texture of Barnes fine sandy loam varies from fine sandy loam to a well-balanced loam. The soil contains more coarser sand than is usual in the loam mapped in the county. In a few borings on some of the flatter areas the material even approached clay loam in texture. Small sandy areas and small flat areas of Beadle fine sandy loam are also included in mapping. Except for the area in Savo Township, the soil contains more alkali than the better areas of Barnes loam.

Practically all of this soil is mapped in the northwestern corner of the county. The largest areas are in Franklin Township, in Allison Township west of Elm River, in the northern half of Palmyra Township, and east of Maple River in Savo Township. The largest single area extends from the county line to the junction of Maple and Elm Rivers. The soil occurs on the divides, and the surface is undulating. The areas are broken by sloughs and flats lying between the higher areas. During excessively wet periods, these depressions fill with water and often merge, isolating areas of the Barnes soils.

This soil is not so highly prized as the better areas of Barnes loam and Barnes silt loam. The general crops are grown with about average yields, but the soil is considered best adapted to corn as it warms up early in the spring, allowing early planting.

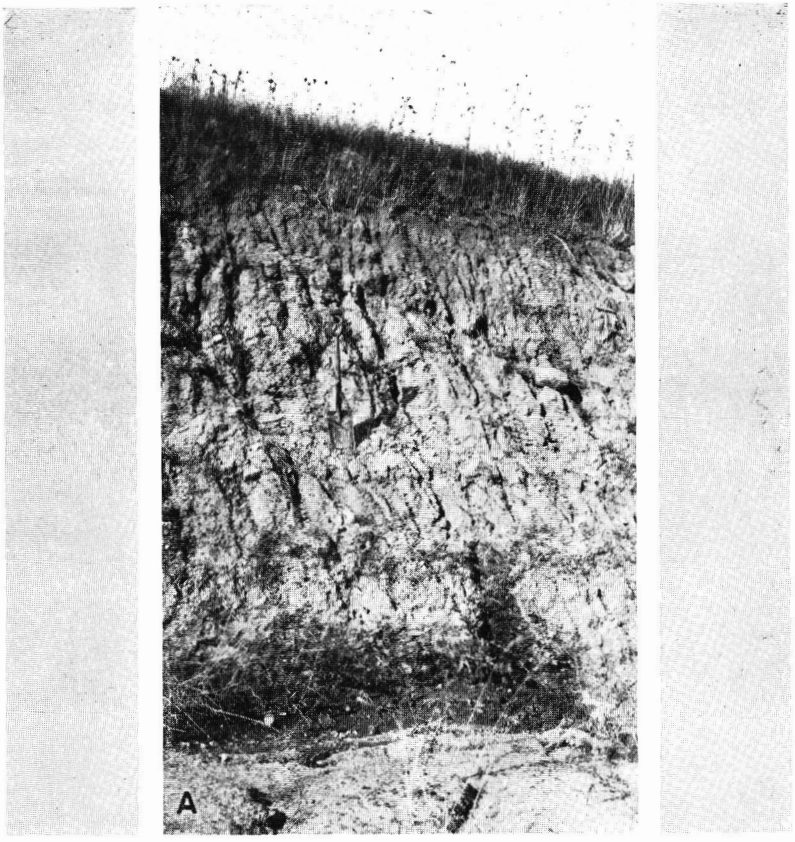
BEARDEN SILT LOAM

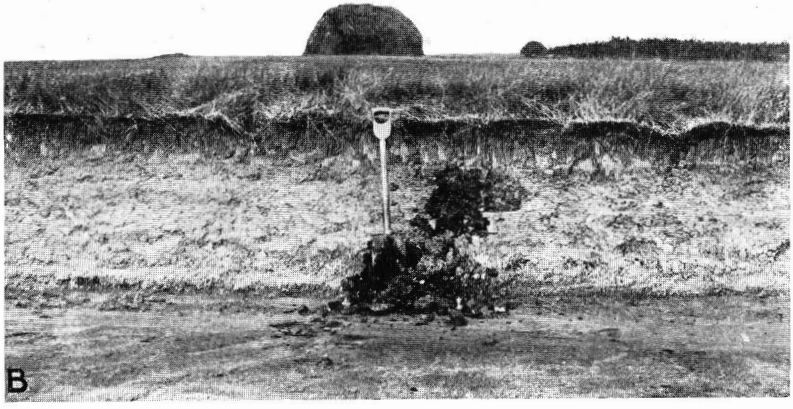
The surface soil of Bearden silt loam is very dark grayish-brown or almost black, friable, finely granular silt loam from 6 to 10 inches thick. It reduces easily to smooth silt loam when pressed between the fingers, and when plowed it is readily brought to a mellow condition. The subsurface soil is brown heavy silt or silty clay loam continuous to a depth ranging from 16 to 28 inches, and is underlain by the highly concentrated lime zone. This lime zone consists of smooth floury silt loam varying in color from almost white to grayish yellow. The surface soil grades in many places into yellow silty clay just above the lime-concentration zone. At a depth ranging from about 36 to 48 inches the lime zone passes into yellow, smooth, floury, calcareous, silty clay loam. The lower part of the subsoil in many places has a platy structure.

The two upper layers and 2 or 3 inches of the lime zone have the columnar structure common to the Barnes soils. In some areas the subsurface soil is slightly compact and heavy, similar to the corresponding layer in the Beadle soils and approaching the Aberdeen soils. There is some variation in the soil, but it is friable and rather uniform. Along James River and some of the winding channels running through the large areas, there is a narrow strip of soil which is slightly coarser than typical and which seems to be of loessial origin. Areas mapped along Elm River are somewhat stratified, have a dark-brown subsoil, and are not calcareous.

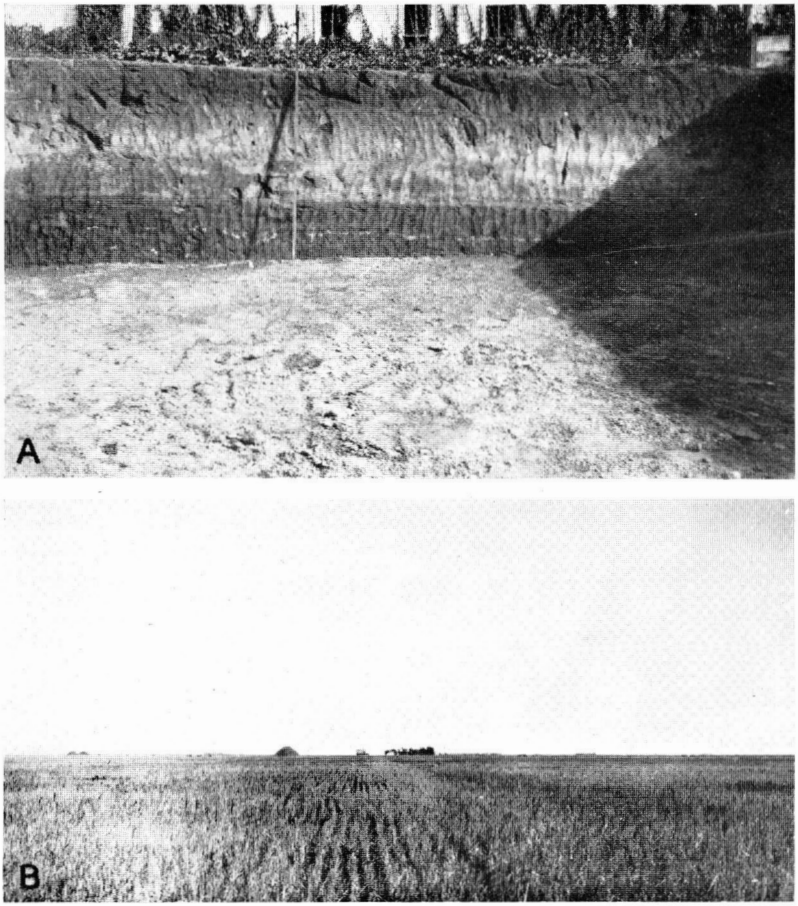
Bearden silt loam occurs in a large area in the Lake Dakota basin. Two other areas are in the vicinity of Columbia and Tacoma Park. Another narrow strip is mapped along the James River bottoms north of Columbia. Areas north of Mud Creek and east of James River are probably a little heavier throughout than is most of the soil. The area mapped 5 miles east of Groton is probably lighter textured than typical, as it contains a high percentage of very fine and fine sand. It approaches very fine sandy loam in texture.

The surface of Bearden silt loam (pl. 2, B) is flat or at most only faintly undulating, and is broken only by the many old stream channels that pass through it. Owing to the structure of the soil it is capable of absorbing and retaining large amounts of water. Drainage is good or excellent. As a whole, Bearden silt loam is a highly prized soil, and on account of its relief and freedom from stone it is easily and economically cultivated. Most of the common crops are





A, Road cut through a soil of the Barnes series showing the zone of lime accumulation; B, profile of a member of the Beadle series showing the sharp division line between the surface soil and subsoil



A, Profile of Bearden silt loam, showing the layer of lime accumulation; B, typical Bearden silt loam and Aberdeen silt loam landscape

grown, but most farmers agree that corn does better than on the Barnes soils. Alfalfa and sweetclover also give excellent yields. Small grains do well, and a large acreage is planted to wheat and oats. Most of the farms are well improved.

Bearden silt loam, shallow phase.—The shallow phase of Bearden silt loam is dark grayish-brown friable silt loam containing a higher percentage of fine and very fine sand than the typical soil. The surface soil, which is from 4 to 6 inches thick, is underlain by the typical brown subsurface soil, which is commonly a little heavier than the surface soil. Below a depth ranging from 14 to 18 inches is the grayish-yellow highly concentrated lime zone which, at a depth ranging from 24 to 36 inches, passes into yellow, highly calcareous till with some gray and brown coloration. A few bowlders and some gravel are on the surface, particularly on the stream slopes. The average depth to the till is about 30 inches, but on knolls it is considerably less. The shallower areas are those nearest or adjacent to the Barnes soils.

This soil blends or thins out as the Barnes soils in the east are approached. Consequently the separation in mapping is more or less arbitrary. The line of separation was more easily followed in Bates than in Hanson and Groton Townships. On the west the soil blends into the typical Bearden soils. All of the Bearden silt loam, shallow phase, occurs in the southeastern corner of the county on a terrace between the Lake Dakota basin and the Barnes soils. A number of areas of this soil broken only by narrow strips of alluvial soil taken together occupy a horn-shaped area with the base of the horn along the county line in Groton Township and the tip at Verdon. Very little of this soil is uncultivated. Wheat and corn are the principal crops, and both give good results. The relief is sloping or slightly undulating, and knolls of Barnes soils project up through the surface covering.

Bearden silt loam, channel phase.—The channel phase of Bearden silt loam has a friable dark grayish-brown or black silt loam surface soil from 4 to 7 inches thick, underlain by a dark-brown or black friable subsurface layer. Below a depth ranging from 16 to 20 inches is grayish-yellow or grayish-brown highly calcareous material which is underlain, at a depth between 24 and 28 inches, by yellow silt. This soil, as a rule, seems to occupy a position in age between the Lamoure or recent flood-plain soils and the typical Bearden soils. It varies considerably in texture, ranging from heavy silt loam to very fine sandy loam. The soil is often much darker through out than typical Bearden silt loam. The surface and subsurface layers are black or dark brown and the lime-concentration zone is brown. Some areas within this phase, however, show the typical soil profile. Sandy gray or brown layers may occur throughout the soil, and in such areas the subsoil is lighter textured than the surface soil. The typical columnar structure in the mature Bearden soils is not everywhere well developed in the channel phase.

This soil is mapped in the lower positions, such as the lower terraces along James River and the depressions of old and present streams. A large area is along Mud Creek in the southeastern corner of the county and another area is along Snake Creek in the southwestern corner. Most of the soil is mapped south of Columbia and east of Aberdeen in the old lake bed, but a few small areas are in

other parts of the county and some spots occupy isolated sloughs. As a rule the soil occupies a position from 15 to 25 feet below the surrounding typical Bearden soils.

The same crops are grown on this as on the typical soil, and about the same results are obtained. During extremely wet years crops may be damaged to some extent by water that collects in these lower areas from the surrounding higher areas.

BEARDEN LOAMY VERY FINE SAND

The surface soil of Bearden loamy very fine sand, to a depth ranging from 4 to 12 inches, is very dark grayish brown, is friable, and has very little structure. When wet it is almost black. The subsoil, to a depth of 28 or more inches, is brown or grayish-brown loamy very fine sand of about the same texture and of slightly more cloddy structure. The zone of lime accumulation, which varies from very fine sandy loam to smooth friable floury silt, begins in most places at a depth between 28 and 36 inches below the surface, but in most places it lies deeper than in Bearden very fine sandy loam. It continues to a depth of 40 or 44 inches and is underlain by a yellow silt or unleached very fine sandy subsoil. The parent material, as in the Barnes and other Bearden soils, is grayish yellow. The surface soil contains from 75 to 90 per cent fine and very fine sand in varying proportions, but commonly the very fine sand predominates. When the soil is dry and the surface is bare, the material blows easily. The subsoil in areas containing the higher percentage of very fine sand is commonly siltier and shallower than in areas containing a high percentage of fine sand. It has the typical columnar structure of the Barnes and Bearden subsoils.

This soil comprises the greater part of the area in the northeastern corner of the county, east of James River and north of a line extending from 3 miles north of Columbia to Putney, thence to Claremont. A large area is also mapped northeast of Aberdeen in Ordway and Bath Townships, and smaller areas are mapped elsewhere. Areas along the State line are probably the sandiest in texture. The lighter or more open variation occurs between James River and Crow Creek.

The relief varies from smooth to slightly undulating, and drainage is good. A number of large sloughs or marshes are in the northern part of the large area. Most of the soil east of Crow Creek is in cultivation, and good yields of corn, wheat, and sweetclover are obtained. In the northern and sandier part of the county a smaller percentage of the soil is under cultivation, but it is considered suited to corn and sweetclover and good crops of small grain are often grown. The soil as a whole is considered one of the best corn soils in the county.

Care should be taken in the management of Bearden loamy very fine sand to prevent blowing. The soil should not be left exposed for long periods. A crop rotation including cover crops which would supply organic matter to hold the soil together should be followed. Cultivating at right angles to the direction of the prevailing winds often reduces damage from blowing. Some farmers list corn to lessen the danger from blowing sand, but others contend that check-rowed corn is just as sure of success.

Bearden loamy very fine sand, basin phase.—The surface soil of Bearden loamy very fine sand, basin phase, is dark grayish-brown

friable loamy very fine sand to a depth ranging from 5 to 8 inches. This grades into grayish-brown or brown very fine sandy loam beneath which, at a depth ranging from 18 to 24 inches, is the gray or yellowish-gray silty lime-concentration zone. At a depth of 30 or 40 inches this material grades into the yellow mottled silt loam that underlies all the Bearden soils.

The zone of lime concentration in this soil is uniformly whiter and contains a higher percentage of lime than does that of Bearden very fine sandy loam. The surface soil also contains a higher percentage of organic matter and appears slightly heavier. As a rule, the basin phase occupies flats which are slightly lower than the greater part of the Bearden very fine sandy loam. This soil is apt to be slightly later in the spring, owing to its wet condition, but it is not so poorly drained as the Maple and Fargo soils.

Most of the Bearden loamy very fine sand, basin phase, is cultivated. Some consider it slightly more productive than typical Bearden loamy very fine sand. It is practically all mapped in the northeastern part of the county, where it is associated with the other sandy Bearden soils. A large part is mapped along the east side of James River, where this soil occupies a position between the heavier bottom soils and the higher Bearden soils and Valentine soils.

This soil occupies low terraces. As a whole it contains more alkali than Bearden loamy very fine sand, and the salts, in places, give a grayish cast to the surface. It is considered of about the same agricultural value as typical Bearden loamy very fine sand.

BEARDEN VERY FINE SANDY LOAM

The surface soil of Bearden very fine sandy loam is very dark grayish-brown or black friable very fine sandy loam to a depth ranging from 10 to 20 inches. To a depth of 2 or 3 inches, the surface soil shows very little structure, but below this surface mulch the material is finely granular. The subsurface soil is brown or dark-brown granular very fine sandy loam to a depth ranging from 28 to 36 inches. The lower 2 or 4 inches of this layer is in most places lighter in color than the upper part. Below this layer is the highly calcareous zone of lime concentration. This consists of grayish-yellow or almost white silt loam or very fine sandy loam containing a high percentage of silt. The high lime content and heavier texture are not found everywhere but are generally more noticeable than in Bearden loamy very fine sand. Below a depth of 42 or more inches is yellow silt or very fine sandy loam. Faint gray mottles are found in many places in this material, which is structureless and highly calcareous.

The larger areas of Bearden very fine sandy loam are in the northeastern part of the county. One large irregular area extends from 3 miles southeast of Hecla to Claremont, thence to Putney. Large areas are mapped northeast of Columbia, and other areas are throughout the county, mostly in the old lake bottom. The area extending from the east-central part of Detroit Township to Putney is probably heaviest in texture. The large areas northeast of Aberdeen and Columbia are similar texturally. The area at Randolph includes a small area of bottom or low terrace. This area and the one south of Mud Creek and northwest of Randolph probably more

closely resemble Bearden loamy very fine sand than the remainder of the soil. There is considerable intermingling of small areas of these two soils.

The relief is level or undulating. The soil is uniformly smoother than Bearden loamy very fine sand and does not have the tendency of that soil to become hummocky or blow.

Corn, sweetclover, and oats are the chief crops. Small grains are better adapted to this soil than to Bearden loamy very fine sand. In cultivating this soil a system should be adopted which would prevent blowing and would incorporate organic matter.

BEARDEN LOAM

Bearden loam has a friable, mellow, finely granular dark grayish-brown or black loam surface soil from 7 to 10 inches thick. This grades into brown, friable but slightly more compact loam continuous to a depth ranging from 24 to 30 inches. A lime concentration zone lies below this depth.

Gravel is present in places at a depth of 30 inches, but as these areas are not droughty they have been included with this soil in mapping. The surface soil is a well-balanced loam containing various grades of sand and some clay. Small areas of Bearden fine sandy loam along Elm River and its tributaries are included in mapping. These areas have a fine sandy loam surface soil but a true Bearden profile.

Very little of this soil is mapped. The two largest areas are in the southeastern corner of the county about 2 miles east of Ferney. The soil as a whole is highly prized and is considered best for corn, although some small grains are grown on it. Nearly all of it is under cultivation.

BEARDEN SILTY CLAY LOAM

The surface soil of Bearden silty clay loam, to a depth ranging from 4 to 8 inches, is very dark grayish-brown or black medium or finely granular silty clay loam very similar to the surface soils of the Fargo and Lamoure soils. The subsurface layer is dark-brown or black heavy silty clay loam or clay which breaks up into small cubical or rectangular particles from one-eighth to one-fourth inch in diameter. The surface and subsurface layers have the columnar structure common in the Barnes soils. At a depth ranging from 20 to 26 inches the highly calcareous grayish-yellow lime zone characteristic in soils of the county occurs. At a depth ranging from 34 to 38 inches, this lime zone grades into yellowish-brown or yellow calcareous silty clay. The upper and second layers may effervesce with acid in places, but this is not typical. The soil is uniformly composed of the finer-grained soil particles and is much more even in texture than the Barnes soils.

This soil occurs on second bottoms or on lacustrine formations. Areas along streams are subject to very rare overflows. One large area is along the lower part of Moccasin Creek and smaller areas are along various large sloughs and depressions of James River in the northern half of the county. Several areas are in the southeastern corner of the county, the largest in sections 14 and 22 of Groton Township.

The areas mapped along the river differ considerably from the rest of the soil. They occupy a low terrace, generally between the Lamoure soils and the higher Bearden soils of the lake basin. These areas along the river have subsoils of gray or grayish-yellow sandy clay, which grades into loam and fine sandy loam at a depth between about 30 and 36 inches.

Bearden silty clay loam is naturally a fertile soil and is well adapted to most of the common crops. Wheat is the principal crop, but corn and sweetclover do well. The soil warms up slowly in the spring, and during some years the crops are apt to suffer from excess moisture.

VALENTINE LOAMY VERY FINE SAND

The surface soil of Valentine loamy very fine sand is dark grayish brown or grayish brown to a depth varying from 8 to 12 inches. This grades into a lighter-brown very fine sandy subsurface soil. At a depth of 30 or 36 inches the subsurface soil grades into yellow, pale-yellow, or grayish-yellow loose, incoherent fine sand which continues to a depth ranging from 4 to 10 feet. The deep part of the subsoil is practically the same as that of dune sand. No lime is found in the soil at any depth, except in small local areas which approach the Bearden soils in composition. The surface soil after being tilled becomes loose and incoherent.

As mapped in Brown County, this soil includes two distinct phases. The one described is associated with the sandy Bearden soils in the northeastern corner of the county. A variation is found in the prairie regions of the western and northwestern part, in Palmyra, Osceola, Allison, and Franklin Townships. This variation is associated with Barnes fine sandy loam. The relief is more strongly undulating than in the northeast corner. This soil is underlain by Barnes till at a depth between 3 and 6 feet. The soil covering contains considerable fine and medium sand. Flat areas along some of the small streams in the northwestern part of the county which resemble Bearden fine sandy loam except for their low lime content were included with this soil in mapping. Valentine loamy very fine sand on these flat areas has included with it a number of small spots of Fargo and Maple soils. The areas in the western and northwestern parts of the county are not so susceptible to drifting as those in the northeastern part. The areas in the Lake Dakota basin are much finer textured and are uniformly deeper. They seem to occupy a position between Bearden very fine sandy loam and dune sand.

This soil is capable of absorbing large quantities of moisture, and it withstands drought well. It is considered more adapted to corn than to other crops, although in some years small grains give fair yields. The highest acre yield of corn in the county was produced on this soil. Alfalfa and sweetclover should do well on it. A large part of it is used for pasture land.

ABERDEEN SILT LOAM

The surface soil of Aberdeen silt loam when moist is dark grayish brown or black, but when dry it has a grayish-brown cast. The texture varies from silt loam to heavy silt loam with a friable consistence and fine granular structure. The surface soil extends to a

depth ranging from 7 to 14 inches and is commonly slightly heavier in the lower part. Below this layer is a gray or grayish-brown layer ranging in thickness from 1 to 3 inches. The gray color may be in a coating over the soil granules or the material may be distinct brown or ash-gray floury silt with some brown mottling. Just below this gray zone is a compact heavy clay layer, varying in color from black to reddish brown. Soils showing the thicker layer are mainly black in the upper part, grading into reddish-brown, and then into yellowish-brown, moderately friable material. The brown color appears in the thinner soils which, as a rule, are better suited to crops. When wet this layer is sticky and waxy. It corresponds to the heavy compact zone of the Beadle soils but is developed in the lacustrine or alluvial soils. It varies in thickness from 3 to 12 inches, but averages about 6 inches. This layer and those above have the typical columnar structure of the eastern Dakota soils. Below a depth ranging from 18 to 24 inches is the zone of lime concentration, which is commonly heavier textured than in the Bearden soils. The typical yellow or yellowish-brown silty clay subsoil, mottled with drab and rust brown, is found at a depth between 36 and 42 inches. There are probably more gypsum crystals in the deep part of the subsoil than in the Bearden soils. The heavy compact layer may be developed in spots from 20 to 50 feet in diameter, in lens-shaped beds thinning out toward the edges. This soil, as a whole, differs from the Bearden in that the surface soil, when almost dry, has a grayish cast rather than the browner color. Some brown iron concretions may appear on the surface.

The majority of the Aberdeen silt loam is mapped in the two southern tiers of townships in the lake basin. As a rule those areas mapped between James River and Mud Creek have a decidedly heavier and darker compact layer than those mapped west of James River. A narrow belt of Aberdeen silt loam occurs along the foot of the Barnes soils and extends from the county line south to Ordway.

Drainage is inferior to that on the Bearden soils. During excessive rains, water collected in some of the lower areas damages crops, and also in years of excessive drought crops are injured. A natural terrace of slightly higher ground bordering the old stream channels interferes with good surface drainage from this soil.

This soil is best adapted to small-grain crops, as there is no doubt that the heavy compact layer interferes with the root development of deeper-rooted crops. Corn is less adapted to the soil but is grown to a considerable extent with good results. The land is not considered quite so valuable as the Bearden soils, but the farms are well improved.

ABERDEEN SILTY CLAY LOAM

Aberdeen silty clay loam has a heavy dark-brown or black silt or silty clay loam surface soil, from 7 to 12 inches thick. It is probably a little heavier textured than that of Aberdeen silt loam, but it has the same columnar and granular structure. The gray layer has about the same variation in the two soils, but the heavy compact zone is probably uniformly better developed in the silty clay loam. The layer of lime accumulation is also heavier than in the silt loam. In sections 17, 20, 29, and 32 of T. 122 N., R. 60 W. and sections 10 and

11, T. 122 N., R. 64 W., this soil includes areas in which fine or very fine yellow sand occurs at a depth of 30 or 36 inches. More alkali is associated with this soil than with the silt loam of the series. In some small spots the quantity is sufficient to prevent crop growth. Such a condition occurs on the Yellowstone Trail east of Groton. Most of the alkali occurs in the subsoil. Small areas of the Fargo soils are included in mapping.

This soil occurs in two general areas. One occupies a position between Bearden silt loam and Bearden silt loam, shallow phase. It extends as a chain of areas in a northeast-southwest direction, with its northern limit in the northeast corner of Groton Township and its southern limit near Verdon. The other area occupies a similar position in the southwestern corner of the county, bordering the eastern edge of the Barnes soils. This series of areas begins near Aberdeen and extends southward past Mansfield. A number of small streams or gullies empty their contents over these two strips, and this is one reason why they are so varied. They are more poorly drained than Aberdeen silt loam, contain more alkali, and are not considered as desirable soils.

BEADLE SILT LOAM

The surface soil of Beadle silt loam, to a depth ranging from 6 to 10 inches, has a dark grayish-brown cast but appears black when wet. It is friable and breaks up readily into fine particles. The surface soil is in most places underlain by a grayish-brown or brown layer extending to a depth of 12 or 16 inches, where it passes abruptly into heavy, compact clay varying from black to brown in color. This heavy compact layer breaks up into rectangular or cubical clods. The edges of these granules are not rounded, as are those of granules in the Barnes soils. This heavy compact layer, where thinner, is brown, grading downward into lighter-brown friable material similar to the brown subsurface layer of the Barnes soils. The more pronounced development has a black heavy clay layer which grades into a browner layer resembling that described, then into the more friable subsurface soil.

A distinct gray silty ashlike layer, 1 or 2 inches thick, is in many places but not everywhere found just above the heavy compact zone. It may exist as a distinct zone or the gray material may be a coating over the soil granules. In wet weather this layer is more difficult to detect. The heavy layers of this soil have the columnar structure typical of the Barnes soils. The heavy compact layers vary from 2 or 3 inches to 10 inches in thickness. Below a depth between about 17 and 20 inches is yellow friable silty clay loam containing a high percentage of lime. At a depth of 30 or 36 inches this is underlain by the grayish-yellow till common in the Barnes soils. Gypsum crystals are found in abundance in many places just below this lime zone, and iron concretions are present on the surface in places. The point of contact of the heavy compact layer and the layer above is sharp and distinct. This heavy compact layer is not continuous or uniform but thins out in places and may be absent in spots.

Gravel and bowlders are associated with this soil as with the Barnes soils. As mapped in Brown County the surface soils contain uniformly more clay and more alkali than those of the Barnes soils, and as a rule this soil is more poorly drained than the Barnes

soils, and a large number of so-called buffalo wallows or burn outs occur. Small depressions from a few inches to a foot below the general level occur in places. These depressions are usually wet in early spring and contain more alkali than the remainder of the soil. The surface soil is likely to be heavier and shallower in such places. Beadle loam is mapped in the areas in which the Pierre shale is comparatively close to the surface or in comparatively poorly drained places.

The principal areas of this soil are in the western tier of sections of Oneota Township and in Carlisle, Ravinia, Mercier, and Highland Townships. The areas have a general north-and-south trend. Two narrow strips in which this is the prevailing soil border the edge of Lake Dakota basin, one extending from the vicinity of Aberdeen southwestward into Warner Township and the other lying in Bates Township in the southeastern part of the county.

As in other Brown County soils no particular attention is paid to special crop adaptations of Beadle silt loam, although it is recognized as being best adapted to the shallow-rooted small-grain crops. Wheat is the principal crop to which it is planted, but a considerable acreage is planted to corn which gives good results in favorable years. Crops suffer both from excessive moisture and from drought. This soil, as a rule, is not so well improved as the more favorable phases of the Barnes soils. A larger percentage of it is used for pasture and hay land.

SIOUX LOAM

The surface soil of Sioux loam is dark grayish-brown or almost black loam or fine sandy loam from 4 to 10 inches thick. The subsurface layer, which extends to a depth ranging from 18 to 24 inches, has about the same texture but is possibly slightly more compact and less easily broken down. The open, porous subsoil commonly consists of bedded, stratified calcareous sands and gravel varying in color from gray to rust brown. A grayish, highly calcareous layer 1 or 2 inches thick in most places lies just above the gravel. The parent material was originally laid down by water, the varying current velocity producing the stratified condition.

Sioux loam is mapped in small areas throughout the western and southern parts of the county. The largest area, extending from Ordway southwest along the Chicago & North Western Railway, appears to be an old alluvial fan of Elm River. The subsoil of this area varies considerably. In some borings the material differs from typical in having a stratified gray and brown sandy subsoil in which there is little or no gravel. To a depth of 1 or 2 feet, the sand is brown and low in lime. Areas bordering Aberdeen silt loam north of Ordway have, in places, a heavy layer, similar to that in the Beadle soils, just above the gravel. Other important areas were mapped just southwest of Aberdeen, southwest of the junction of Elm and Maple Rivers, 2 miles north of Frederick, and 4 miles southeast of Westport. Included in mapping is a small area of Sioux fine sandy loam 2 miles west of Frederick. All of these areas have the typical stratified sand and gravel subsoil.

Sioux loam occurs along streams, as a terrace or as outwash plains and fans from older and larger streams. The relief is flat or gently sloping. The soil is planted to the customary crops, with varying

results. During years of drought crops suffer considerably from lack of moisture, especially where the gravel is closest to the surface. In years of heavy rainfall, crops do very well. Early-maturing crops, such as early potatoes and barley which are harvested before the drier late summer months, would probably do best. If the water table is sufficiently close to the surface, legumes will probably give good results. Corn is considered a good crop for Sioux loam, as the soil warms up early, enabling the corn to get an early start. The gravelly subsoil, where found with the proper mixture of gravel, sand, and clay, makes good road-surfacing material, and large quantities are used for that purpose. The cleaner gravel is used in concrete construction.

EDGELEY LOAM

The virgin surface soil of Edgeley loam is dark grayish brown or black and is from 3 to 5 inches thick. It has a fine granular structure. The subsurface or upper subsoil layer, to a depth ranging from 12 to 20 inches, is brown, is finely or medium granular, and is of about the same texture as the surface soil. Below the subsurface soil is the lime-concentration zone common to the Barnes soils. This layer is in most places rather gravelly and contains a higher percentage of shale fragments than does the corresponding layer in the Barnes soils. Below a depth ranging from 22 to 36 inches, this grades into decomposed shale or till composed mostly of shale. This material is underlain by less-weathered shale and by the practically unweathered material at a depth of 3 or more feet. The depth to the rotten shale or till composed of shale varies greatly but is everywhere less than 4 feet. The brown upper subsoil layer of the Edgeley soils is in many places much heavier than the corresponding zone in the Barnes soils and is rather closely related to the Beadle soils.

Edgeley loam occurs on flats along the streams in the western part of the county, mainly on eroded terraces. Some areas occupy old, shallow, flat stream valleys which were later filled with drift. The largest areas are in a disconnected strip extending from the southeastern corner of Franklin Township south through the eastern part of Carlisle Township. Another area is along Foot Creek northwest of Richmond. Small areas are mapped elsewhere.

Most of the Edgeley loam is used for pasture or hay land. Probably about one-third is in cultivation. The soil is ordinarily stony on the surface. The common crops are grown with varying results, owing to the spotted condition of the soil. Large numbers of buffalo wallows or burn outs containing considerable alkali are present. Crops in these spots dry up in periods of drought or drown out during periods of excessive rainfall. Flax thrives on this soil, and sweetclover should do fairly well. The small grains produce better than corn. This soil is not so highly prized as the greater part of the Barnes soils.

FARGO SILT LOAM

The surface soil of Fargo silt loam, to a depth of 6 or 8 inches, is dark grayish-brown or black silt loam or heavy silt loam. This grades into black or dark-brown silty clay loam which may or may not be mottled with drab or gray. At a depth of about 20 inches

this is underlain by drab or grayish sticky plastic clay mottled somewhat with brown or yellow. Below a depth of 40 or 50 inches is yellow silty clay beneath which the water deposits are in many places underlain by till. Where the till occurred at a depth of 3 feet or less the areas were mapped with the Maple soils, but where the deposits were deeper the soil was classed with Fargo silt loam. This soil varies widely in depth, color, and content of lime. A zone of lime accumulation is found in many places in the soil. The subsoil is everywhere and the surface soil is in places calcareous. In a few places the subsoil is yellow at a depth between 32 and 36 inches. All these variations may occur in the same area.

Fargo silt loam occurs in irregular-shaped sloughs and potholes and on stream terraces. The large area 4 miles southeast of Groton on Mud Creek has a terrace position and includes spots approaching Aberdeen silt loam in appearance and other spots having a sandy subsoil within a depth of 3 feet. This variation in texture is due to the deposition of various grades of sediments during flood. This area and the two near Ferney lie at about the same level as the surrounding soils. They contain considerable alkali. The greater part of the soil, especially in the prairie plains, lies from 6 to 15 feet lower than the surrounding soils.

The greater part of the Fargo silt loam is used for pasture or for hay land. Corn does well in favorable years, but small grains, especially wheat, are probably most certain to succeed. Sweetclover should do well unless the seasons are excessively wet. Drainage is poor or indifferent.

A heavier soil, which in most places is silty clay loam, was included with this soil in mapping, on account of its small area. This phase occurs in the Lake Dakota basin. One of the largest areas is 3 miles south of Ordway, and another is in an old stream channel 1¼ miles west of Ferney. The area near Ordway is underlain by sand in many places. This heavy phase does not differ greatly from the typical silt loam in its agricultural value.

FARGO CLAY

The surface soil of Fargo clay, to a depth ranging from 6 to 10 inches, is black clay which breaks up into fine particles. When wet the soil is plastic and sticky. Organic matter from 2 to 4 inches thick is present in many places on the surface. The subsurface soil is black clay of about the same structure and texture, but it contains a high percentage of lime and seems to be a zone of lime accumulation. This lime-impregnated zone continues to a depth varying from 22 to 28 inches, where it is underlain by black, drab, or grayish plastic calcareous clay. The gray subsoil is in many places mottled with brown or yellowish brown.

This soil is mapped in the more poorly drained parts of Brown County, chiefly in sloughs and lakes but also on terraces. The sloughs and lakes vary greatly in size and are generally very irregular in shape. They also differ greatly in the quantity of water they normally hold. Some contain water throughout the year and are of little or no agricultural value. Many of the areas mapped are permanent swamps and lakes. Other sloughs dry up late in summer and furnish an abundance of pasture or grass for hay. Such sloughs

are not considered as interfering with the value of a farm, as they furnish forage and grass with the least possible trouble. Other areas contain water only early in the spring, drying up in time to be available for cultivated crops.

Fargo clay occurs throughout the county in both the prairie plains and lake-bed regions. Some of the largest areas are in the southeast corner of T. 126 N., R. 63 W., in sections 33 and 34 of Groton Township, along the sloughs east of Groton, in the southeast corner of Riverside Township, north of Mansfield, and southwest of Aberdeen. Smaller areas are scattered throughout the county.

This soil is used mostly for pasture and hay land. Probably about one-fourth of it is in cultivation. The principal crop is wheat, although some sweetclover and corn are grown. The soil is fertile and produces excellent yields when the seasons are favorable. Owing to its heavy texture it is very difficult to handle and must be worked under optimum moisture conditions to prevent clodding under cultivation. Large areas of Fargo clay on farms comprising Barnes soils have a tendency to lower the land value. It is doubtful if drainage would be feasible.

MAPLE SILT LOAM

The surface soil of Maple silt loam, to a depth ranging from 5 to 9 inches, is black silt loam or silty clay loam. This commonly grades into dark-gray silt or silty clay loam which, at a depth of 16 or 20 inches, passes into gray or drab, highly calcareous silt loam. Platy structure is common, especially near a depth of 3 feet. The gray highly calcareous zone, which is not everywhere present, varies in thickness from 2 to 12 inches. Below the silt loam is dark-drab calcareous clay, which grades into yellow calcareous slay mottled with drab and brown and containing grit or sand and gravel. This material, which appears to be water-logged till, may occur only 18 or 20 inches below the surface. Low knolls of Barnes soils along the Sunshine Highway north of Aberdeen are included with mapped areas of this soil. The areas occur in imperfectly drained flats where the surface material is of lacustrine origin, and in sloughs and potholes.

Maple silt loam occupies most of the sloughs throughout the county, particularly those within areas of the Barnes soils. The soil is most extensive in the northern part of the county. Alkali is present in varying amounts and is probably abundant in the areas a few miles southwest of Aberdeen.

Those areas mapped in the Lake Dakota basin have a subsoil very similar to that of the Bearden soils. The principal areas of this variation are in Portage and Detroit Townships in the northeastern part of the county and in the slough east of Groton. The largest areas within the upland are north of Aberdeen in the vicinity of Pond Lake, in sections 14 and 23 of Highland Township, and 2 miles west of Sand Lake.

Very little of this soil is cultivated. Its chief use is for pasture and hay land.

MAPLE LOAM

Maple loam has a friable, easily crumbled, black surface soil from 6 to 12 inches thick, which varies from loam to fine sandy loam. The subsurface soil, to a depth ranging from about 26 to 34 inches,

is dark-gray or grayish-brown loam. Below this is sandy clay of about the same color. Below a depth between 36 and 40 inches is yellowish-gray silt loam mottled somewhat with brown. There is no uniformity in color or texture in the subsoil, as it occurs in successive layers of sand and clay. Accumulations of alkali are common.

Like the other Maple soils, Maple loam is poorly drained. It occurs in sloughs or low places where it is submerged most of the year, and the water table is close to the surface the remainder of the year. Some of the larger and more important areas are northeast, east, and southeast of Hecla and along the slough north and west of Huffton. Another area is 2 miles east of Sand Lake. Some of these areas occur in a broken chain of low areas. Most of them lie within drainage districts, but they are only comparatively well drained. Practically all the soil is used for pasture or hay land and this is its chief value. Probably sweetclover could be grown profitably on sufficiently well-drained areas.

MAPLE FINE SANDY LOAM

Maple fine sandy loam has a black fine sandy loam surface soil about 20 inches thick. To a depth ranging from 7 to 10 inches more organic matter is present than below that depth. Below a depth of 20 inches is black or dark grayish-brown fine sandy loam or loam continuous to a depth of 24 or 28 inches. Below this is gray silt loam or very fine sandy loam containing a high percentage of lime and some alkali. This gray calcareous silt loam grades into the yellow silt mottled with drab at a depth of about 40 inches. This subsoil is similar to that of the Bearden soils. In some areas deposits of organic matter or peaty substances from 3 to 8 inches thick are on the surface. The soil occurs in low, poorly drained areas such as small lake beds and sloughs and supports a luxuriant growth of cattails or other water-loving flora. Most of the soil is mapped in the northeastern part of the county in the sand district. The largest area is in the slough occupied by Crow Creek which enters James River in the vicinity of Tacoma Park. Another large area is mapped 3 miles northeast of Hecla. The smaller areas are along James River in association with the Bearden soils.

Drainage ditches running through the two large areas remove most of the water, but these and nearly all other areas of the soil are too wet during the spring for cultivation. Alkali is present in sufficient amounts to damage crops. The chief value of Maple fine sandy loam is for pasture and hay land.

MAPLE CLAY

The surface layer of Maple clay, to a depth ranging from 3 to 10 inches, is black and plastic when wet but when dry breaks up into medium or fine granules. The surface soil may or may not contain sufficient lime to effervesce with hydrochloric acid. The subsurface soil, which extends to a depth ranging from 20 to 28 inches, is dark-brown clay and is stickier than the surface soil. Beneath it is gray or brown mottled silty clay containing a small amount of gritty material. This layer is highly calcareous. Below a depth ranging

from 36 to 40 inches is gray and brown mottled till. Crystals of gypsum are abundant in many places in the subsoil. Some borings showed only a very thin poorly developed gray layer above the till.

The Maple soils, like the Fargo, occur in depressions or sloughs, not all of which are so well defined as those in which the Fargo soil was mapped. They are in most places imperfectly drained depressions in the till plain where water has stood for a sufficient period of time to allow accumulation of lacustrine deposits. Small low knolls of Barnes loam are scattered over most of these areas. Maple clay probably occurs in deeper depressions than Maple silt loam.

A variation of Maple clay mapped along James River includes the more desirable phases of the soil and about one-half of the total area mapped. This variation has a black surface soil, a dark-brown subsurface soil, and a drab clay subsoil which contains some fine sand. The sand content gradually increases until at a depth of about 30 or 40 inches the material becomes gray or gray mottled with brown fine sandy loam. This soil occupies a low terrace position in the higher parts of the bottoms or lies between the Lamoure and Bearden soils. It consists of fine-grained alluvial deposits over sand. It is mapped principally in the north half of the county. Most of it is used for pasture and hay land, but some areas are in crops, principally wheat. Very little of the soil, except that found along the river, is cultivated.

The principal slough areas are in T. 126 N., R. 63 W., T. 125 N., R. 63 W. and R. 65 W., T. 124 N., R. 64 W., in the vicinity of Rudolph, 4 miles northwest of Mansfield, along Foot Creek west of Aberdeen, and 3 miles east of Groton.

LAMOURE SILT LOAM

The surface soil of Lamoure silt loam is black finely granular silt or heavy silt from 5 to 7 inches thick. It is underlain by a black silty clay loam subsurface soil to a depth ranging from 18 to 22 inches. The surface soil is finely granular, but the subsurface particles are more angular. The subsurface soil grades into black or dark-brown clay and this in turn, at a depth of 26 or 28 inches, passes into dark silty clay loam. At a depth of about 36 inches mottling becomes noticeable and increases with depth. The subsoil contains sufficient lime to effervesce with hydrochloric acid and in some places the entire soil effervesces.

The large area of Lamoure silt loam, mapped along Elm River south of Columbia, is uniformly a little heavy for a silt loam. Another area, mapped along Mud Creek in the eastern part of Hanson Township, is very spotted, having a loam or clay loam surface soil and a sandy subsoil. The variable structure and texture no doubt result from the overflows to which the area is subject during periods of heavy rainfall.

The largest area is along Moccasin Creek. It has a subsoil which is heavy and compact in spots, resembling that of the Aberdeen soils. The subsoil is also browner, with grayish or drab mottles and is also in general slightly lighter textured than typical. An included area of Lamoure loam along the upper forks of Elm River and Willow Creek varies from loam to silty clay loam within a short distance. The area along Maple River north of Frederick contains considerable very fine sand.

This soil is not very well drained. Drainage is best along Moccasin Creek and the lower part of Elm River. Most of the soil is used as pasture and hay land. Wheat is the principal crop, and corn and oats are grown with varying success. Wheat yields about 15 bushels to the acre.

LAMOURE SILTY CLAY LOAM

The surface soil of Lamoure silty clay loam, to a depth ranging from 4 to 8 inches, is black or very dark grayish-brown silty clay loam in which in many places there is a grayish cast. This breaks up into medium or fine particles with rounded edges. The subsurface soil, to a depth of 10 or 12 inches, is commonly grayish silty clay loam which breaks into finer particles than the surface soil. This grades into black calcareous clay containing a large amount of accumulated lime. This material crumbles readily into fine particles with sharper edges than the surface soil. At a depth between 26 and 30 inches the lime becomes disseminated throughout the soil material and is not concentrated as in the layer above. The subsoil is black or dark brown and is of about the same structure as the overlying material.

Nearly all of this soil occurs along James River and Mud Creek. It occupies the higher land and better-drained areas along the river, but along Mud Creek it occupies the lower situations. Some of the larger areas are in section 25 of Rondell Township, in section 3 of Gem Township, east of Bath, and southeast of Columbia. Most of the soil is in cultivation, principally to wheat. This soil is more easily handled than the clay of the same series. It is fertile but is not so highly prized as Bearden silt loam. The more poorly drained areas are used for pasture and hay land.

LAMOURE CLAY

The surface soil of Lamoure clay is black sticky clay when wet, but when dry it breaks up into fine angular particles. The surface soil has a thickness ranging from 8 to 12 inches. Below this is black clay of about the same characteristics, which in many places contains sufficient lime to indicate a lime accumulation. This layer extends to a depth ranging from 26 to 30 inches and is underlain by dark-brown or dark-drab clay mottled somewhat with brown. As mapped along James River, the deep subsoil seems lighter textured or more silty in spots. Lamoure clay differs from Fargo clay in its development over recently laid deposits instead of on terrace and lacustrine deposits.

Lamoure clay, as a rule, is more poorly drained than either Lamoure silty clay loam or Lamoure silt loam. Most of the James River bottom is Lamoure clay, and the soil is mapped along James River throughout the county. North of Sand Lake and in Henry Township the river bottom varies from 1 to 1¾ miles in width. For about 4 miles north of Sand Lake, a large part of the bottom is swampy throughout the year or until late in summer. During the spring the wider river bottoms are apt to be wet and subject to overflow. The entire bottoms overflow easily, and very little of this soil north of Sand Lake is cultivated, the entire area being used for hay or pasture land.

Wheat gives excellent results on this soil, as does corn in favorable seasons. Sweetclover produces a luxuriant growth. The soil is very fertile but is difficult to handle because of its heavy texture. It is locally known as gumbo. Some areas have been protected from overflow by levees. Although its producing value is recognized, this soil is not so highly valued as Bearden silt loam and Barnes silt loam, because of the difficulty in handling it.

PIERCE FINE SANDY LOAM

Pierce fine sandy loam has a dark grayish-brown or black, friable, finely granular surface soil from 5 to 9 inches thick. This is underlain to a depth ranging from 14 to 24 inches by brown friable fine sandy loam or loam. Below this is a stratified bed of calcareous sand and gravel, which differs from the bedded gravel of the Sioux soils in being cross-bedded, whereas in the Sioux the material is more in horizontal layers.

Pierce fine sandy loam is associated with the glacial soils and occurs on low ridges or as knolls from 15 to 25 feet higher than the surrounding Barnes soils. It is mapped principally in the southwestern part of Carlisle Township, in section 36 of Liberty Township, and northeast of Ferney. The soil is tilled and planted to the same crops as the surrounding Barnes soils. During years of dought, crops suffer. The gravelly subsoil material is used in road construction.

DUNE SAND

The surface soil of dune sand is brown or dark-brown loose incoherent fine or medium sand from 3 to 8 inches thick. The surface soil grades into brown sand of the same characteristics, which becomes lighter colored with depth and at a depth ranging from 16 to 20 inches commonly grades into yellow or grayish-yellow fine loose sand. Lime is present in a few places.

In Brown County dune sand occurs in a strip across the eastern edge of Portage Township in the northeastern corner of the county. It consists of irregular and broken ridges of low hills with intervening flats. This land is used as pasture. When the sod is broken, the wind cuts the soil out and the sand drifts, covering other areas with sand and burying the grass. Care should be taken to prevent the sod from being broken. Only a very small proportion of the flatter areas is in cultivation. Corn is the principal crop.

SUMMARY

Brown County is in the northeastern part of South Dakota. The land area is 1,719 square miles or 1,100,160 acres. The relief varies from flat to strongly undulating. The internal drainage of most of the soils is good, and surface drainage is fair except in the large number of low sloughs, lakes, and marshes. Stream dissection is not thorough.

Brown County has three principal physiographic divisions: The prairie plains, Lake Dakota basin, and the flood plains.

The average elevation of the county is from 1,300 to 1,400 feet above sea level.

The first settlement was made in 1865. Aberdeen, the second largest city in the State, is the county seat.

The railroads of the county reach within 10 miles of all farms. The principal markets are St. Paul, Minneapolis, Sioux City, Sioux Falls, and Chicago.

Farming in the county tends toward a well-balanced system of raising feed crops and livestock. Some farmers, however, still derive their income chiefly from grains. Wheat is the principal crop, but corn, oats, barley, and flax combined have a larger acreage than wheat. Sweetclover and alfalfa are grown to some extent, but the majority of the hay is wild hay. Beef and dairy cattle, hogs, and poultry are very important sources of farm income.

Crop rotation is practiced only in a general way. Most farms are well improved, with the most modern farm implements in use. The percentage of farms operated by tenants is gradually increasing.

The soils of Barnes County have weathered for a sufficient length of time under the same conditions to have developed very similar profiles except in small areas where the influence of weathering agencies has been modified by poor drainage.

The principal mature well-drained soils derived from glacial till are the Barnes soils, with very dark grayish-brown surface soils, brown subsurface layers, zones of lime accumulation, and less-weathered yellow or grayish-yellow subsoils. The Beadle soils differ in having a heavy compact clay zone just above the zone of lime accumulation. The Edgeley soils differ from the Barnes soils in having a shale subsoil.

The lacustrine and old-alluvial soils having the same general characteristics as the well-drained upland soils are classed in the Bearden series. The Aberdeen soils of the terraces have a compact subsoil layer corresponding to that of the Beadle soils. The Beadle and Aberdeen soils are less well drained than the Barnes and Bearden soils.

Other old terrace soils have dark-colored surface soils but are underlain by bedded, stratified sand and gravel. These are known as the Sioux soils. The Pierce soils of the upland are very similar to the Sioux soils.

Other water-laid soils are classed in the Fargo and Maple series. These soils are poorly drained, occupying the flats, sloughs, and low terraces. They have black surface soils, black or brown subsurface soils, and black, drab, or gray subsoils. Their chief value is for pasture and hay land and for the production of wheat on the better-drained areas.

The recent-alluvial soils occupy the first bottoms. They have black surface soils and heavier brown, black, or drab calcareous subsoils.

The lake-basin soils are recognized as being well adapted to corn, whereas the Barnes soils are probably better adapted to wheat, as are also the Beadle and Aberdeen soils.

[PUBLIC RESOLUTION—No. 9]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]

Areas surveyed in South Dakota, shown by shading

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
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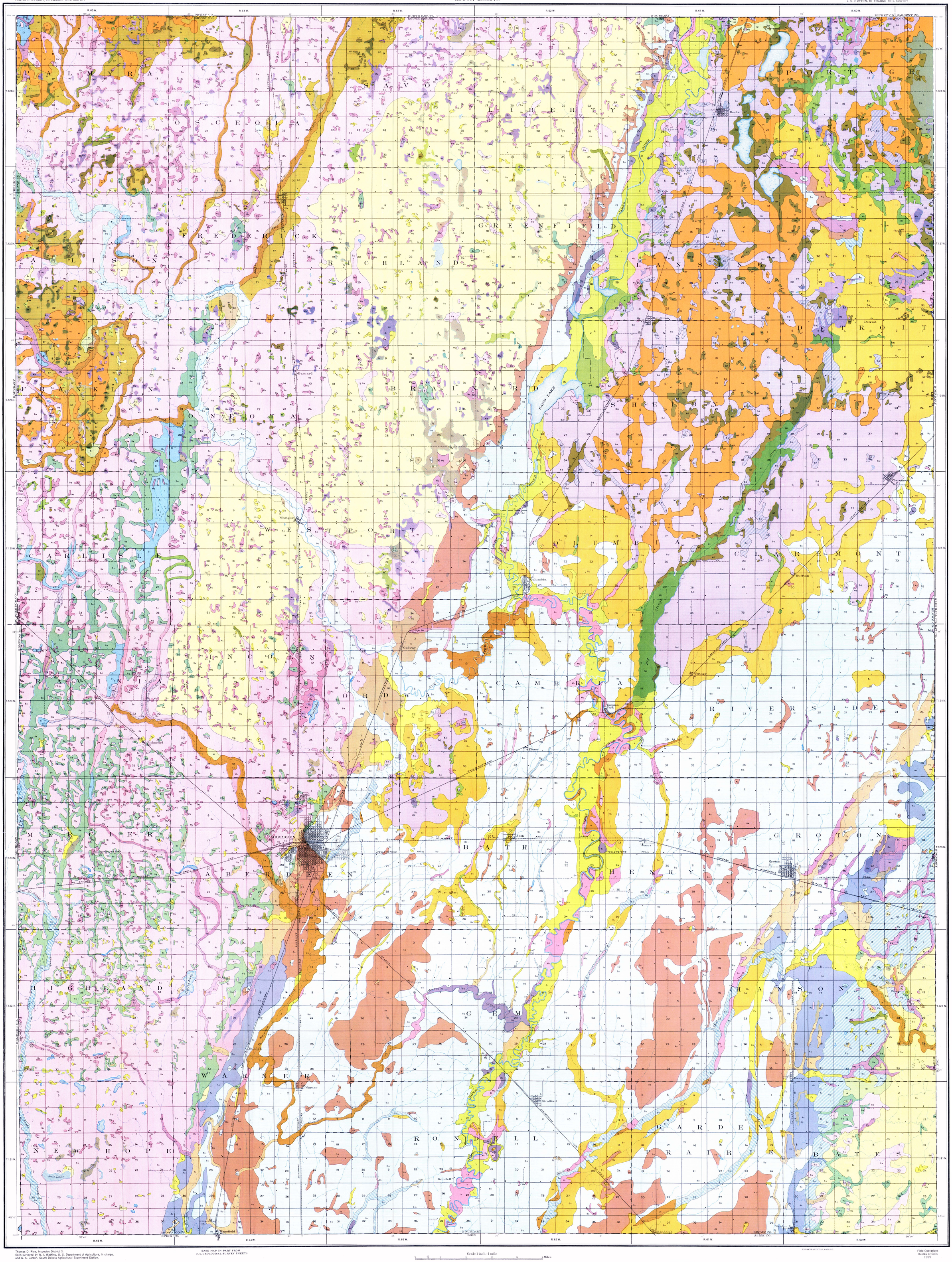
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
BROWN COUNTY
SOUTH DAKOTA

SOUTH DAKOTA AGRICULTURAL EXPERIMENT STATION
J. W. WILSON, DIRECTOR
J. G. HUTTON, IN CHARGE SOIL SURVEY



LEGEND

Aberdeen silt loam — As	Readie silt loam — Be
Aberdeen silty clay loam — Ac	Edgeley loam — El
Barnes fine sandy loam — Bf	Fargo silt loam — Fs
Barnes loam — Ba	Fargo clay — Fc
Ba — Rough stony phase	Lamoure silt loam — Ls
Barnes silt loam — Bs	Lamoure silty clay loam — Lc
Bearden loamy very fine sand — Bd	Lamoure clay — L
Bd — Basin phase	Maple fine sandy loam — Mf
Bearden very fine sandy loam — Bv	Maple loam — Ml
Bearden loam — Bl	Maple silt loam — Ms
Bearden silt loam — Bo	Maple clay — Mc
Bo — Shallow phase	Pierce fine sandy loam — Pl
Bo — Channel phase	Sioux loam — S
Bearden silty clay loam — Bc	Valentine loamy very fine sand — Vl
Dune sand — D	

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
Secondary roads and Trails
Railroads, Steam and Electric
Bridges, Ferry
R.R. crossings, Tunnel
Ford, Dam
School or Church, Cemeteries
Mine or Quarry, Mine dumps, Made land
Bluff, Escarpment, Rock outcrop, and Triangulation station
Stony and Gravelly areas
Soil boundaries
Boundary lines
Boundary lines
Boundary lines
U.S. township and section lines

RELIEF
(Printed in brown or black)

Contours, Depression contours
Prominent Hills, Mountain Peaks
Sand Wash, and Sand dunes
Shore and Low water line, Sandbar

DRAINAGE
(Printed in blue)

Streams
Lakes, Ponds, Intermittent lakes
Intermittent streams
Springs, Canals and Ditches, Flumes
Swamp, Salt marshes
Submerged marsh, Tidal flats

The above signs are in current use on the soil maps, but not all of them may appear in every map of another state.

Thomas D. Rice, Inspector, District 3.
Soils surveyed by W. I. Watkins, U. S. Department of Agriculture, in charge, and G. A. Larson, South Dakota Agricultural Experiment Station.

BASE MAP IN PART FROM U. S. GEOLOGICAL SURVEY SHEETS

Scale 1 inch = 1 mile
1/2 0 1 2 3 4 Miles

WILLIAMS & HEINTZ CO. WASH. D.C.

Field Operations
Bureau of Soils
1925